The Westinghouse Company at present manufacture five sizes of these dynamos, having capacities ranging from five hundred to five thousand 16-candle-power lights. The machine shown in the cut is the No. 2 dynamo, having a capacity of fifteen hundred lights.

The field-coils in these machines are supplied with current from a separate exciter, which is simply a small direct-current machine. The exciter may be driven by an independent engine, or it may, if desired, be attached to the shaft of the dynamo, in which case the dynamo is said to be self-exciting.

The armature of this dynamo is a structure of great simplicity. The body is of laminated iron plates, freely perforated for ventilating purposes. A single layer of wire is wound in flat coils back and forth across the face of the armature, parallel with the shaft, being held in place by stops on the ends of the armature. Mica and other insulation is provided, and the whole is wrapped with binding-wire. A ventilator is attached to each end of the armature, drawing a strong current of air through, thus insuring a sufficient degree of coolness. These armatures are uniformly wound to deliver a current of a thousand volts, a higher voltage than this for special circuits being obtained when necessary by means of a special converter. The absence of a commutator will be noticed in the illustration, its place being taken by two plain collecting-rings without breaks of any kind. Narrow collectors rest upon these rings, taking off the current as it is generated. With these collecting-rings it is obvious that the adjustment of the collectors is a matter of indifference, as no sparking can occur under any circumstance, there being no interruption of the current. The matter of dust or more or less oil has no effect, the whole device resolving itself into a detail of great simplicity.

GEOLOGICAL SURVEY OF NEW JERSEY.

THE work of this survey has been steadily prosecuted during the past year. In the annual report for 1887 it was stated that the Topographic and Magnetic Surveys of the State were completed, and that the reports upon these would be prepared and printed as rapidly as possible. This work is done, and the first volume of the final report of the Geological Survey of New Jersey is being distributed. It is an octavo volume of 450 pages, and contains a report on the Geodetic Survey by Professor Edward A. Bowser; on the Topographic and Magnetic Surveys, by C. C. Vermeule, C.E.; and on the climate of the State, by Professor John C. Smock. It also contains two maps of the State on a scale of five miles to an inch, — one showing its civil divisions; and the other, its elevations, mountains, ridges, valleys, and plains, together with its rivers and its drainage areas.

The work now preparing for publication as the second volume of the final report will contain a full catalogue of the minerals found in the State, with their localities; a catalogue of all the plants growing in the State, with notes of their occurrence and localities; and also catalogues of its vertebrate and invertebrate animals. Appendices to these catalogues will give some practical and economic particulars regarding them. Most of the work of preparing these catalogues is already done.

So much attention has been given in former reports to the study and description of the geological structure of the rocks of the State, that the work still to be done is mainly in combining and systematically arranging the materials which have been collected by various persons who have made New Jersey a study in former years. This is especially the case with the marl and clay formations in the middle of the State, and the limestones, slates, and sandstones in the north and north-western portions. There are some obscure and difficult points of structure in the red sandstone and the gneissic rocks; but it is thought that important progress has been made in clearing up these difficulties, and that the volume on structural geology can be prepared as soon as that above mentioned is out of the way, and that one on the economical geology can then properly complete the series.

The prompt publication and liberal distribution of the results of the State surveys have continued to meet the approval of the citizens, and to supply suggestive and needed information. The expenses of printing, mailing, and expressage are large; but the returns in the development and wealth of the State abundantly justify the expenditure. The whole system of artesian well-boring was started at the direct suggestion of the survey, and it has brought inestimable sanitary and pecuniary benefits to the whole Atlantic coast, and has been of great service throughout the State. The description of the location and structure of our fire and potters' clays, and its publication, have caused the development of some of the best clay properties in the country, and have made public the immense stores of the best plastic and refractory materials in the immediate vicinity of the great manufactories and markets of the continent. The preparation and publication of the topographic maps, in advance of those of any other State, have tended to draw attention to the peculiar advantages of New Jersey in its location, its varied surface, its healthful seaside and mountain resorts, its water-supply, and its unequalled means of travel and communication. The maps are studied by engineers for projected improvements, by citizens seeking homes in the country, by land-owners who desire to improve or open their properties, as well as by intelligent and inquiring citizens of all kinds who are interested in the development and prosperity of the State. The publication of the condition of the mines, quarries, lime-production, marls, drained lands, water-supplies, and other matters of general interest, is continually inciting to new enterprises and the investment of capital; and the notes in regard to soils and the means for their improvement are helping to develop agriculture, and to greatly increase its products.

The public supply of pure and wholesome water to the people of the cities, towns, and villages, is of growing importance; and it needs to be kept before those who should reap the benefits of it. That there are abundant supplies of the best of water to be found in New Jersey, has been pointed out in several of the annual reports. Perhaps that of 1876 contained the most of detail. A bare repetition of some of the points may help to give a more definite idea of the magnitude and importance of the supply, as well as to keep the subject prominently in view.

From many years' observations it was shown that the annual rainfall varied in different years from about 30 inches in the driest years to about 60 inches in the wettest years, and that the average rainfall in all northern New Jersey was $44\frac{5}{10}$ inches per year. Observations upon the amount of water to be collected from the Croton watershed show that 60 per cent of the rainfall runs off in the streams. For purposes of safe calculation, however, it was assumed that only 40 per cent of the minimum rainfall should be depended upon: 40 per cent of 30 inches is 12 inches. From a square foot of surface, then, a cubic foot of water can be saved every year, or $7\frac{1}{2}$ gallons. From an acre, 326,700 gallons can be collected per year, or nearly 900 gallons per day. From a square mile there can be collected 209,088,000 gallons per year, or daily 572,844 gallons.

The watershed of the Passaic River above Little Falls is 750 square miles, being made up of the drainage areas of the following-named streams: Ramapo River, 148 square miles; Wanoque River, 108; Pequanac River, 82; Rockaway River, 165; Whippany River, 59; Passaic River, 188; total area of the Passaic and its branches, 750 square miles. Greenwood lake, with a drainage area of 32 square miles, is included in the Wanoque area. Lake Hopatcong, with a drainage area of 27 square miles, naturally found an outlet by the Musconetcong River into the Delaware; but, by the dam across its outlet, its surface has been raised so as to find an outlet by the Morris Canal into the watershed of the Passaic. The total area to be drawn from is, then, 777 square miles. This area can be depended upon to supply 500,000,000 gallons of water daily. At Little Falls, all this water is in one stream, at an elevation of 158 feet above mean tide; and it is only 16 miles from the centre of Newark, and 22 miles from the centre of Jersey City, or only about half the distance from which the Croton water is carried to New York. By going a few miles farther up the streams, most of the water could be collected at an elevation of 250 feet, or high enough to supply all of those cities by gravity.

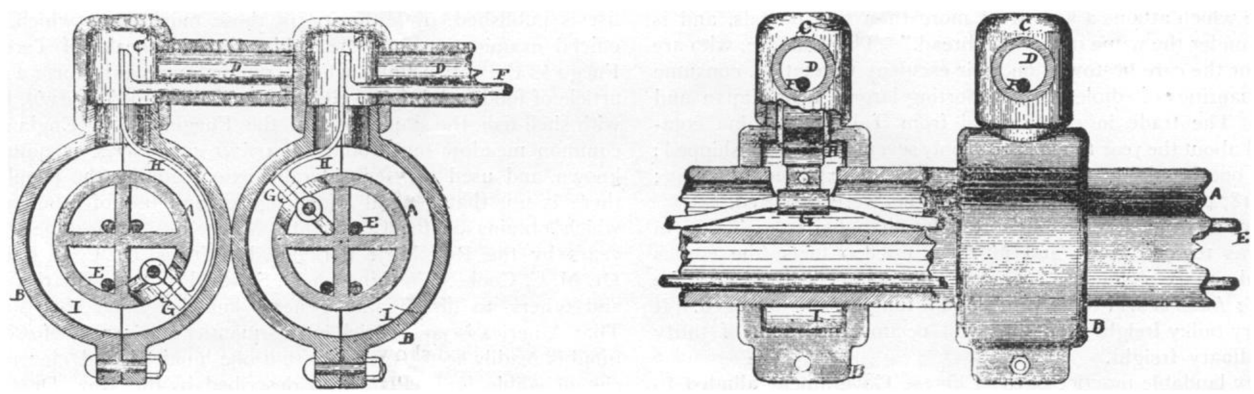
The quality of this water is unquestionable in purity. It is mostly gathered from a country which is mountainous, mostly in forest, and likely to remain so for a long time to come. As a substitute

for the filthy water supplied to almost half the people of the State, it is of incalculable value, and there should be no delay in securing its health-giving benefits.

The artesian wells bored at various points on the Atlantic coast between Sandy Hook and Cape May continue to yield a supply of good and wholesome water, and some very satisfactory ones have been sunk along the Delaware.

THE MEDBERY UNDERGROUND SYSTEM.

WE have to record this time another instance of the moving in cycles of human progress. As the first water-pipes for distributing water through towns were made of wood, to be afterwards made of iron and iron and cement, so now an inventor has produced a wooden pipe, not necessarily for use in conveying water, but more especially for use as a conduit for electric conductors. This pipe is made from long wood fibres, separated, washed free from saps and gums, and then moulded while in a pulpy state into the requisite size and shape, being subjected to great hydraulic pressure. After this it is treated and hardened by a chemical process, that, it is believed, renders it impervious to moisture, acids, or gas. The piping looks not unlike iron, but is, of course, much lighter, and is made in sections which can be joined by threads, like iron pipes, with a sleeve coupling. The pipes can be made continuous, thus preventing gases or moisture coming in contact with the enclosed wires. Each conduit is divided into four or more compartments, as shown in the illustrations; and the wires occupy separate ducts, which precludes the possibility of cross-circuits. The question of insulating wires is one of considerable importance, and the expenditure is necessarily very great; but in this conduit, by reason of the high insulating power of the material, expensive insulation of the wires is avoided.



FIGS. 1 AND 2.—THE MEDBERY UNDERGROUND SYSTEM.

Another noteworthy feature of this system is the method of distributing to houses and street-lamps. Usually it is necessary to make provision for this when laying the conduit, which is necessarily very expensive; but by this system side taps and connections can be as easily made at any time after the conduit is laid, and without serious expense, as will be explained from the accompanying illustrations, Figs. 1 and 2.

When desiring to make connection with the main line, the conduit is exposed at any point, and an opening is cut in it in any preferred manner. It is usually drilled. The wire is then lifted from its resting-place in the conduit, through the hole in the conduit; and the two parts of the metallic clamp *G*, being first separated, are put over the wire, and firmly attached thereto by means of a screw. The clamp has a chamber into which a suitable metal or solder is melted or fused, making a perfect contact and permanent joint. The two sides of the casing or connecting box (which, it will be seen, has a recess or hollow interior) may be filled with suitable insulating-cement while in a plastic state, and they are then placed about the conduit in such a manner that the extension of the clamp *H* projects through the neck of the casing, as shown in the cut. The bolts are then inserted in the lips of distributing-duct *B*, and screwed up. The cap *C* is then applied, and forced firmly down upon the tapering neck of the casing, after being properly cemented. The branch wire is then connected with the extension from the clamp *H*, and, when it has been passed through the first length of the branch conduit *F*, the branch conduit is screwed into the threaded hole in the side of the cap *C*, or, preferably, cemented into place. The branch line can thus be extended as far as may be desired. Thus far in the process, connection has been made with one wire only, either the negative or the positive wire, but of course the connection with the other wire will be made in a similar manner.

The system as above outlined is being introduced by the American Indurated Fibre Company of Mechanicsville, N.Y., from whom further information may be obtained. It may be mentioned that satisfactory practical work with it has been done by the Bell Telephone Company of Philadelphia, the Pennsylvania Railroad Company, and other parties.

EDIBLE MUSHROOMS OF THE UNITED STATES.

FOR several years past the division of microscopy of the United States Department of Agriculture has been in receipt of numerous letters from regular correspondents and others, from which it appears that in various localities, representing almost every section and climate of the Union, there are found large quantities of edible mushrooms and other allied fungi; few of which, however, are utilized, owing to the inability of the great majority of the people to distinguish the edible species from the poisonous ones. To obtain some clear and trustworthy criteria by which to make this essential distinction has been the object of the various communications received; and in view of the highly nutritious properties of this class of esculents, and of the great possible value of their aggregate product as indicated by the vast quantities produced in countries where attention is given to their cultivation, the importance of a satisfactory answer to these inquiries will be readily appreciated. This answer is given in a little pamphlet on twelve edible mushrooms of the United States, illustrated with twelve colored types, by Thomas Taylor, M.D., microscopist of the Department of Agriculture, Washington, D.C.

Rollrausch and Siegel, who claim to have made exhaustive investigations into the food-values of mushrooms, state that "many species deserve to be placed beside meat as sources of nitrogenous nutriment;" and their analysis, if correct, fully bears out the statement. They find, in 100 parts of dried *Morchella esculenta*, 35.18 per cent of proteine; in *Helvella esculenta*, 26.31 per cent of proteine, from 46 to 49 per cent of potassium salts and phosphoric acid, 2.3 per cent of fatty matter, and a considerable quantity of sugar. The *Boletus edulis* they represent as containing in 100 parts of the dried substance 22.82 per cent of proteine. The nitrogenous values of different foods, as compared with the mushroom, are stated as follows: "proteine substances calculated for 100 parts of bread, 8.03; of oatmeal, 9.74; of barley-bread, 6.39; of leguminous fruits, 27.05; of potatoes, 4.85; of mushrooms, 33.0." A much larger proportion of the various kinds of mushrooms are edible than is generally supposed, but a prejudice has grown up concerning them in this country which it will take some time to eradicate. Notwithstanding the occurrence of occasional fatal ac-